Behavioural activation treatment for depression in individuals with neurological conditions: A systematic review

Lloyd L. Oates,[1,2] Nima Moghaddam,[1] Nikos Evangelou,[3] and Roshan das Nair[4,5]

1. Trent Doctorate in Clinical Psychology, University of Lincoln, UK.
2. Lincolnshire Partnership NHS Foundation Trust, Lincoln, UK.
3. Division of Neurosciences, University of Nottingham, Nottingham, UK.
4. Institute of Mental Health, Nottingham, UK.
5. Division of Psychiatry & Applied Psychology, University of Nottingham, Nottingham, UK.

Lloyd Oates - Email: 16662517@students.lincoln.ac.uk Telephone: +44 (0)1522 886029;
Nima Moghaddam - Email: NMoghaddam@lincoln.ac.uk Telephone: +44 (0)1522 886029
Nikos Evangelou - Email: nikos.evangelou@nottingham.ac.uk Telephone: +44 (0) 115 8231449
Roshan das Nair - Email: Roshan.Dasnair@nottingham.ac.uk Telephone: +44 (0) 115 74 84240

Correspondence to: Professor Roshan das Nair, Professor of Clinical Psychology & Neuropsychology, B19, Institute of Mental Health, Jubilee Campus, University of Nottingham, Nottingham, NG7 2TU, UK.
Email: *Roshan.Dasnair@nottingham.ac.uk*

Word count: Abstract 247, main text 3452, tables 2, figures 1

Abstract

Objective: To evaluate the effectiveness of behavioural activation interventions for people with neurological conditions with co-morbid depression, and explore content and adaptations.

Data sources: PsycINFO, MEDLINE, CINAHL, AMED, and EMBASE databases were searched on the 19/11/19. Reference lists of selected full-texts were screened by title.

Review methods: We included peer-reviewed studies, published in English that used behavioural activation for treatment of depression in adults with a neurological condition. Single case reports, reviews, and grey literature were excluded. Methodological quality was assessed by two authors independently and quality was appraised using Critical Appraisal Skills Programme checklists.

Results: From 2714 citations, 10 articles were included comprising 590 participants. Behavioural activation was used to treat depression in people with dementia (*n*=4), stroke (*n*=3), epilepsy (*n*=1), Parkinson's disease (*n*=1), and brain injury (*n*=1). Sample size ranged from 4 to 105 participants. There were seven randomised-controlled studies, however, no studies compared behavioural activation to an alternative psychological therapy. The effect sizes varied between small and large in the studies where effect size could be calculated (*d*= 0.24-1.7). Methodological quality of the included studies was variable. Intervention components were: identifying and engaging in pleasurable activities, psychoeducation, and problem solving. Adaptions included: delivering sessions via telephone, delivering interventions via primary caregivers, and giving psychoeducation to caregivers.

Conclusion: The effectiveness of behavioural activation in randomised-controlled trials varied from small to large (*d*= 0.24-1.7) in reducing depression. The content of behavioural activation was comparable to established treatment manuals. Adaptations appeared to support individuals to engage in therapy.

Review registration: PROSPERO 2018, CRD42018102604.

*Key words***:** Neurological conditions, depression, behavioural activation, behavioural therapy, activity scheduling

Behavioural activation treatment for depression in individuals with neurological conditions: A systematic review

Introduction

People with neurological conditions experience higher rates of depression than those in other patient groups without neurological conditions [1]. Decreased social activities contribute to the continuation and exacerbation of depression through a loss of contact with contingencies that were previously reinforcing and mood enhancing [2]. Conversely, engagement in social and leisure activities for people with multiple sclerosis promotes positive mood and wellbeing [3, 4]. With depression and reduced or declining physical abilities (common in many neurological conditions), individuals find it difficult to identify with and engage in activities that have pleasurable or reinforcing consequences [2].

In the UK, National Institute of Health and Clinical Excellence recommends the use of cognitive behavioural therapy for treating depression in individuals with chronic physical health problems (including neurological conditions) [5]. However, cognitive-behavioural therapy is not best suited for people with neurological conditions [6], because many have cognitive difficulties that may make accessing and engaging with cognitive-behavioural therapy difficult [7]. Therefore, adapting psychological therapies to better consider the interaction of co-morbid psychological and physical conditions may be more acceptable to people with neurological/physical health conditions [8].

Behavioural activation is a type of psychological therapy that encourages individuals with depression to engage in activities they have been avoiding. Individuals define goals and activity schedules [9]. Behavioural activation is a relatively simple, easy to understand, intervention that does not require a highly trained therapist or complex skills from the patient [10], and may be suitable for individuals with cognitive and physical difficulties.

In non-neurological populations, the behavioural activation component of cognitive-behavioural therapy is as effective alone compared to when used in combination with cognitive aspects [11] – and has been found to be as effective as antidepressant medication [12]. A meta-analysis of activity scheduling (a type of behavioural activation) interventions for the treatment of depression found a pooled effect size (*d*) of 0.87, favouring activity scheduling over waitlist or placebo controls or alternative psychological therapies (95% CI: 0.60~1.15) [13]. Behavioural activation is also considered cost-effective for depression [14]. However, the evidence for the effectiveness of behavioural activation in people with neurological conditions is inconclusive.

Therefore, this review aimed to: (i) report the evidence of the effectiveness of behavioural activation interventions for individuals with neurological conditions with co-morbid depression, with outcomes of interest being mood, function, activity, and quality of life; (ii) describe the content of behavioural activation interventions; and (iii) identify the adaptations made to the behavioural activation intervention specifically for people with neurological conditions.

Method

We followed the PRISMA-P 2015 guidelines [15] and the protocol was prospectively registered on PROSPERO (CRD42018102604).

The following online databases were searched: Medline (1970-present), CINAHL (1970-present), PsycINFO (1970-present), EMBASE (1980-present), and AMED (1980-present). The last search was completed on 19/11/2019. The following keywords were used: Behavioural activation, behaviour therapy, activity scheduling, depression, and neurological

conditions. We used variations of these terms including medical subject headings (MeSH) where available. For a complete list of the search terms please refer to Appendix A. Terms were 'exploded' and used singularly or in conjunction with similar terms based on the database being searched. The reference lists of the selected full-texts were screened by title, as an additional way of identifying relevant articles.

Included studies were: Peer-reviewed, quantitative or qualitative, and published in English. Studies were required to include: (a) behavioural activation for treatment of depression (clinician confirmed diagnosis or scoring above defined thresholds on validated depression measures); (b) adults (≥16 years) with a neurological condition, defined as a condition or disease of the brain, as a result of illness or injury. Studies using behavioural therapy were included where the use of activity scheduling and monitoring was of primary focus; which was defined as the targeting of behavioural avoidance and increasing contact with environmental positive reinforcement. We were primarily interested in clinical effectiveness of the intervention on the patient, but we also included outcomes that related to the care-giver. We excluded articles that were policy papers, books, theses, or conference proceedings.

Data extraction was completed by the first author and accuracy was checked by the other authors. Table 1 summarises the data extracted. Following the database searches, results were transferred to Microsoft Excel and duplicates were removed. The first author screened titles and abstracts, before reviewing full text articles. Data extraction was completed using a predefined template informed by the reader's guide to critical appraisal of cohort studies [16-18] (for the template headings please see Appendix B).

Following PRISMA guidance [16-18], the first and one other author independently assessed the methodological quality of each included article. Discrepancies were resolved through discussion. The quality appraisal framework selected was informed by the study design of the included articles: Critical Appraisal Skills Programme Randomised Controlled Trials checklist [19], cohort studies checklist [20], qualitative checklist [21], and Mixed Methods Appraisal Tool– Version 2011 [22].

A narrative summary for data analysis was conducted due to the low number of articles identified. A meta-analysis was not considered because we only had a small number of studies, with considerable heterogeneity in terms of study designs, outcome measures, and measurement time-points. Therefore, to compare and synthesise effectiveness data, effect size estimates were used (with effect size determined from study data when not reported). Where multiple depression measures were used the primary measure was used. Through conversion into standardised between-condition effect-sizes, we treat studies as comparable with respect to the comparison condition (e.g., that usual care is similar across studies); however, if comparators (e.g., forms of 'usual care') differ systematically across studies, then this assumption (of transitivity) would be violated: the treatment effect will not be defined independently of individual comparators (i.e., there will be a treatment-by-study interaction).

Results

Initial database searches identified 2714 articles, 49 full text articles were considered for inclusion, and 10 articles (with 590 participants) met our inclusion criteria. Figure 1 is the PRISMA flow diagram.

[Figure 1 about here]

All included articles were quantitative intervention studies: seven randomised-controlled trials [23-29], one cohort study [30], and two multiple baseline experimental design studies [31, 32]. The articles were published between 1991 and 2019, based on studies from the USA [23, 26-32], UK [24] and Australia [25]. The components and format of the behavioural activation interventions are summarised in Table 1, which also describes the clinical context of each intervention, and the comparator groups (where used).

[Table 1 about here]

The quality of the studies, as seen in Table 2, was variable. All had a clearly stated aim and identified their target sample. Participant demographics were adequately detailed in almost all studies, but one [32]. Studies and sample representativeness varied from low to high. Sample sizes ranged from 4 to 105 participants [24, 32].

The quality of reporting of the studies also varied. In randomised-controlled trials the method of randomisation was reported in all but one study [23], with most studies using computer generated algorithms [24-30, 32]. In five randomised-controlled trials assessors were blinded to participant group allocation [23, 26-29]; in one study assessors were only blinded to secondary measures [24]; and in one study there was no blinding of data collection [25]. Only two studies reported data on treatment fidelity [24, 30], with most studies collecting no or minimal data on the delivery of the intervention [23, 25-29, 31, 32]. All studies included or described data pertaining to the validity and reliability of assessment measures.

Additional sources of possible methodological biases were evident, such as reporting bias (not detailing all outcomes) [27], use of self-report methods to assess depression [23-28, 30-32], and caregivers completing depression assessments on the participants' behalf [23, 31, 32]. One

study [31] used a single-case experimental design but did not report any statistical analysis or present any data for depression. One study [32] used a single-case experimental design but did not consistently establish a baseline before introducing the intervention, as recommended by multiple single case experimental design standards [33].

[Table 2 about here]

Variants of behavioural activation processes, such as activity scheduling or monitoring were used in samples with dementia [23, 25, 31, 32], stroke [24, 27, 28], epilepsy [26], Parkinson's disease [30], and brain injury [29]. Participants were recruited from nursing homes, hospital clinics and the community. The mean age range was 38.5 to 86.5 years. A number of studies recruited patient-caregiver dyads and investigated the effects of using paid and unpaid caregivers as intervention aids [23, 25, 31, 32]. Additionally, studies reported the impact of behavioural activation for patients, on caregivers' depression, quality of life, and/or perceived burden [23, 30, 32].

The following assessments were used to assess depression outcomes: The Cornell Scale for Depression in dementia [34] [23, 31], The Hamilton Depression Rating Scale [35] [23, 27, 28, 32], Stroke aphasic depression questionnaire 21-item hospital version [36] [24], Geriatric Depression Scale-12 [37] [25, 27, 28, 30], The Patient Health Questionnaire [38] [29], and the Hopkins Symptom Checklist – 20 [39] [26]. Caregiver depression was consistently assessed using The Hamilton Depression Rating Scale [35] [23, 32].

Seven studies used comparator groups; six used a two-arm design, of which, four used usual care for one arm [24, 26-28], one used a walking and talking intervention as a comparison group [25], and one used a motivation intervention [29]. Another study [23] had four arms (behavioural therapy and pleasant events, behavioural therapy and problem-solving, usual

care, and waitlist control). Attrition rates were reported for all studies and ranged from 5% [25] to 27% [31].

In terms of effectiveness (aim i) eight of ten studies reported a positive outcome for behavioural activation in terms of improving depressive symptoms [23, 24, 26, 28-32]. In studies reporting effects favouring the intervention, estimable effect size ranged from d = 0.38–1.7 (for parity, where multiple follow-up assessments were reported, the first post-intervention effect-estimate was selected). When the lowest quality studies were not considered (i.e., limiting to [23, 24, 26, 28]) the effect size range remained the same.

Conversely, two studies did not favour behavioural activation, reporting non-superiority for reducing depression relative to usual care (d at first [8-week] follow-up = 0.24, p = 0.30) [27] or a walking-and-talking intervention (d not reported, p = 0.61) [25].

Overall, across the six studies for which effect-sizes were estimable [23, 24, 26, 27, 28, 30], effects of behavioural activation ranged widely at first follow-up (post-intervention): from small-to-large magnitude (ds = 0.24–1.7). The same range (ds = 0.24–1.7) was observed when limiting to the five studies that estimated effect-size against a comparator [23, 24, 26, 27, 28]; all these effects were estimated relative to a usual care condition, in a randomised-controlled trial design, although the nature of 'usual care' likely differs across populations and between individual studies.

Considering findings by population, there was at least one favourable finding for each study population. Behavioural activation treatment was favoured in three of four dementia-focussed studies (observed ds 0.9–1.7 [at first follow-up]) and two of three stroke-focussed studies (largest observed ds 0.24–1.17), with favourable findings in each of the (single) studies examining effects for patients with epilepsy (d = 0.38), Parkinson's disease (d = 0.70), and brain injury (d unreported).

In terms of effect-sizes at longer-term follow-ups, four randomised-controlled trials [24, 26, 27, 28] provided estimates of effect-size (comparing behavioural activation with usual care) at 5–6 months: these ranged from negligible (0.05 [27]) to moderate (0.77 [24]) magnitude. Of the four randomised-controlled trials, three further provided estimates of effect-size at 12 months, and these again ranged from negligible (0.10 [27]) to moderate (0.70 [26]) magnitude.

Further to effects on patient outcomes, there were reported benefits of patient-focused behavioural activation on caregivers' depression in two studies [23, 32] (reduced caregiver depression on the Hamilton Depression Rating Scale). Another study [24] found no significant effects of patient-focussed behavioural activation on caregiver strain or leisure activities – although caregivers expressed high satisfaction with the care provided.

In terms of content (aim ii), behavioural activation interventions included the use of psychoeducation, identifying pleasurable activities, scheduling pleasant activities, graded task assignments, and problem-solving. The interventions were delivered by study therapists, care home staff, master's degree students, and unpaid caregivers. In one study, behavioural activation was delivered in two formats (face-to-face and telephone) and was compared to usual care [27], however, due to low recruitment numbers and being under-powered the interventions arms were combined and compared to usual care. Across studies, the number of sessions delivered ranged from one [29] to twenty [24], with most studies delivering between six and nine sessions [23-28, 30, 32]. Where reported, the duration of sessions ranged from 10 minutes [27, 30] to one hour [23, 24, 32]. The duration of the intervention in most studies was one hour. One study used a single session followed by eight weeks of daily text messages [29].

With respect to aim (iii), few adaptations were made to the content of the delivered behavioural activation intervention. Where adaptations were made, the most frequent addition to the programme was problem-solving [25-28]. In one study the problem-solving

content was focused on the behavioural challenges, presented by patients with dementia, whereas one study used problem-solving to support access to pleasant activities [25].

Carers were involved in four studies. For instance, psychoeducation was delivered to the caregiver rather than the patient [23, 32], or caregivers (paid and unpaid) assisted in the delivery of behavioural activation [23, 25, 31, 32] or to support access to pleasant activities [25, 31]. Where caregivers were used to deliver behavioural activation, reduction in low mood for patients was shown in two studies[23, 32], but mixed results were found in relation to reduction in patient depression when paid caregivers supported access to pleasant activities.

Finally, the method of delivery in all studies was one-to-one, and no group studies were identified. In one study [32] both the caregivers and patient attended sessions, with the first three sessions attended by both parties, and the remaining five sessions only the caregivers attended. In all but two studies[26, 30], sessions were delivered face-to-face. However, one study used a single face-to-face session followed by a series of text messages; the content of the messages having been agreed during the initial session [29]. In one study [27], one treatment arm received telephone contact, however, the results were combined with the face-to-face arm and compared to usual care.

Discussion

Overall, we found some indication that behavioural activation is effective in the treatment of depression in individuals with neurological conditions with effects maintained beyond a six-month period. Behavioural activation had a varied effect between small and large in the studies where effect size could be calculated (d= 0.24-1.7, in six of seven randomised-controlled trials) in reducing depression. The largest effect size includes the combined reporting of the intervention arms of behavioural therapy pleasant events and behavioural therapy problem solving [23], when excluding the combined intervention arms the same varied

range of small to large effect sizes were observed across included articles. This finding is consistent with a previous meta-analysis, which concluded that behavioural activation for depression in individuals *without* a neurological condition is effective (d = 0.87)[13]. In our review, participants with Parkinson's disease or epilepsy benefitted the most on depression, quality of life, and apathy outcomes. In studies with dementia or stroke samples, varying levels of effectiveness were found. However, these results should be treated with caution, because the quality of some studies was not optimal.

Most studies reported statistically significant differences in the reduction of depression, but effect sizes were not reported in all cases. The variance in the reported outcomes may be a result of the design and delivery of the intervention, clinical condition, outcome measures, timing of assessments, and comparators (or lack thereof). The good quality studies suggested that behavioural activation was clinically and cost effective, and they were reported in a way that would enable replication. The findings from the other studies, however, must be treated with caution because depression was not always the primary presenting difficulty. Furthermore, studies had small sample sizes. Only five of ten studies conducted a sample size calculation or power analysis [24, 26-28, 30], and three studies did not reach their recruitment target [24, 26, 27].

Half of the trials included follow-ups of six-months or longer [23, 24, 26-28]. This is beneficial as it provides an insight into continued benefits of the intervention. All but one [27] - which had no significant benefits in depression outcomes at the end of treatment - reported significant continued benefits at long-term follow-up.

Few studies reported making any adaptations to the intervention specifically for the populations studied. Where adaptations were mentioned, these included adding a problem-solving component to the behavioural activation intervention, delivering sessions by

telephone, and teaching caregivers (paid and unpaid) to facilitate behavioural activation and provide access to pleasurable activities.

One study added a problem-solving component to standard behavioural activation, but it was unclear whether this additional component was specific to overcoming barriers to activities or providing support for individuals' difficulties in day-to-day tasks. A more generic problem-solving approach may have introduced a deviation from behavioural therapy interventions. A lack of fidelity assessment and assessment of participant adherence makes it difficult to determine what the participants actually received in terms of 'content' and the 'dose' of the intervention. Where reported, the average number of pleasant activities completed increased significantly ($p< 0.005$) from baseline, and a significant positive relationship between depressed mood and duration and frequency of pleasant events was identified (mean = 0.72, $SD = 0.16$, $t(3) = 2.07$, $p<0.08$).

In terms of intervention delivery format, we were not able to determine the relative effectiveness of telephone versus face-to-face delivery, as only one study made this comparison, and the outcomes did not differ significantly from each other, however, data were not presented detailing the comparison. Two studies reported a medium effect size in the reduction of depression using a combination of face-to-face and telephone (d=0.70), which suggests that telephone as a mode of delivery may be of benefit to individuals, particularly because some may experience physical difficulties and may struggle to attend appointments. Behavioural activation sessions varied in number and length of sessions. In clinical settings the variability may support clinicians and services with limited resources. However, more research is needed to investigate the effectiveness of behavioural activation in fewer sessions.

Using unpaid caregivers to support the delivery of behavioural activation may be a benefit to both the person with a neurological condition and the caregiver themselves.

Caregivers experienced a reduction in depression, but behavioural activation had no impact on perceived strain/burden. This may be because the person they care for continues to have care needs, with or without the presence of depression, which the caregiver continues to facilitate. Indeed, high care need is associated with higher levels of caregiver strain and poorer quality of life [40].

One strength of this review is that the search strategy was tested, and the search terms were refined with a specialist study librarian before the final search, which increased the likelihood of identifying papers. The electronic search and hand search of full-text reference lists increases confidence that most relevant research was included in this systematic review and that the conclusions made in the review are based on a synthesis of available evidence.

Our findings, however, must be viewed in light of the review's limitations. We could only find a small number of studies to include, and many of the studies had small sample sizes, and considered few neurological conditions. None of the studies compared behavioural activation with another psychological or pharmacological intervention, therefore no direct comparisons of effectiveness were possible. Only peer-reviewed literature was included and as a result the exclusion of unpublished findings may bias the results to demonstrate a positive effect of the intervention. This exclusion criterion was applied to ensure that only methodological robust studies were included. When considering the potential of publication bias, future reviews might benefit from including grey-literature. Finally, only one author screened articles for inclusion.

Future research should consider and address methodological and conceptual limitations of published studies as highlighted in this review. For example, data should be reported for each arm of randomised-controlled trials. Studies should assess the fidelity of the delivery of the behavioural activation intervention, and activity participation should be

recorded as an outcome to determine whether changes are directly related to behavioural activation. A fully powered randomised-controlled trial with longer-term follow-ups, and head-to-head comparisons with alternative psychological therapies, with an evaluation of the cost-effectiveness, to determine which is most effective intervention is warranted.

Clinical messages

- There is some evidence that behavioural activation is beneficial in reducing depressive symptoms in several neurological conditions, although the low quality of studies means the findings should be interpreted with caution.
- Behavioural activation interventions have been delivered in a number of formats such as telephone, face-to-face, and carer supported, with varying number and length of sessions.

Acknowledgements

We would like to thank Dr. Danielle DeBoos for her constructive feedback in regard to the focus and concept of the review during its design.

Contribution statement

All authors contributed to the design, completion and writing of the manuscript. All authors reviewed the final draft.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article. Lloyd L. Oates carried out this work in part fulfilment of the requirements of his Doctorate in Clinical Psychology at the University of Lincoln and the University of Nottingham.

Funding

384 This study was part funded by a grant by Health Education East Midlands, UK.

References

1. Kings Fund. Long-term Conditions and Mental Health: the Cost of Comorbidities. London: Kings Fund, 2012.
2. Kanter JW, Baruch DE and Gaynor ST. Acceptance and commitment therapy and behavioral activation for the treatment of depression: Description and comparison. *The Behavior Analyst* 2006; 29: 161-185.
3. Hakim EA, Bakheit AMO, Bryant TN, et al. The social impact of multiple sclerosis - a study of 305 patients and their relatives. *Disability and Rehabilitation* 2000; 22: 288-293. DOI: 10.1080/096382800296755.
4. Motl RW, McAuley E, Snook EM, et al. Physical activity and quality of life in multiple sclerosis: intermediary roles of disability, fatigue, mood, pain, self-efficacy and social support. *Psychology, health & medicine* 2009; 14: 111-124.
5. National Collaborating Centre for Mental Health and National Institute for Health Clinical Excellence. *Depression in adults with a chronic physical health problem: treatment and management*. London: British Psychological Society and the Royal College of Psychiatrists, 2010.
6. Hind D, O'Cathain A, Cooper CL, et al. The acceptability of computerised cognitive behavioural therapy for the treatment of depression in people with chronic physical disease: a qualitative study of people with multiple sclerosis. *Psychology and Health* 2010; 25: 699-712.
7. Hind D, Cotter J, Thake A, et al. Cognitive behavioural therapy for the treatment of depression in people with multiple sclerosis: a systematic review and meta-analysis. *BMC psychiatry* 2014; 14: 5.
8. Cully JA, Paukert A, Falco J, et al. Cognitive-Behavioral Therapy: Innovations for Cardiopulmonary Patients With Depression and Anxiety. *Cognitive and Behavioral Practice* 2009; 16: 394-407. DOI: 10.1016/j.cbpra.2009.04.004.
9. Veale D. Behavioural activation for depression. *Advances in Psychiatric Treatment* 2008; 14: 29-36.
10. Lejuez C, Hopko DR, Acierno R, et al. Ten year revision of the brief behavioral activation treatment for depression: revised treatment manual. *Behavior modification* 2011; 35: 111-161.
11. Jacobson NS, Dobson KS, Truax PA, et al. A component analysis of cognitive-behavioral treatment for depression. *Journal of Consulting and Clinical Psychology* 1996; 64: 295-304. 1996/04/01.
12. Dimidjian S, Hollon SD, Dobson KS, et al. Randomized trial of behavioral activation, cognitive therapy, and antidepressant medication in the acute treatment of adults with major depression. *Journal of consulting and clinical psychology* 2006; 74: 658.
13. Cuijpers P, Van Straten A and Warmerdam L. Behavioral activation treatments of depression: A meta-analysis. *Clinical psychology review* 2007; 27: 318-326.
14. Richards DA, Ekers D, McMillan D, et al. Cost and Outcome of Behavioural Activation versus Cognitive Behavioural Therapy for Depression (COBRA): a randomised, controlled, non-inferiority trial. *The Lancet* 2016; 388: 871-880. DOI: 10.1016/S0140-6736(16)31140-0.
15. Moher D, Shamseer L, Clarke M, et al. Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 statement. *Systematic reviews* 2015; 4: 1.
16. Gurwitz JH, Sykora K, Mamdani M, et al. Reader's guide to critical appraisal of cohort studies: 1. Role and design. *BMJ: British Medical Journal* 2005; 330: 895.

17. Mamdani M, Sykora K, Li P, et al. Reader's guide to critical appraisal of cohort studies: 2. Assessing potential for confounding. *BMJ: British Medical Journal* 2005; 330: 960.
18. Normand S-LT, Sykora K, Li P, et al. Readers guide to critical appraisal of cohort studies: 3. Analytical strategies to reduce confounding. *BMJ: British Medical Journal* 2005; 330: 1021-1023.
19. Critical Appraisal Skills Programme. CASP Randomised Controlled Trial Checklist., https://casp-uk.net/wp-content/uploads/2018/01/CASP-Randomised-Controlled-Trial-Checklist.pdf (2018, accessed 25th June 2018).
20. Critical Appraisal Skills Programme. CASP Cohort Study Checklist, https://casp-uk.net/wp-content/uploads/2018/03/CASP-Cohort-Study-Checklist-Download.pdf (2018, accessed 25th June 2018).
21. Critical Appraisal Skills Programme. CASP Qualitative Checklist, https://casp-uk.net/wp-content/uploads/2018/03/CASP-Qualitative-Checklist-Download.pdf (2018, accessed 25th June 2018).
22. Pluye P, Robert E, Cargo M, et al. Mixed methods appraisal tool (MMAT) version 2011. *Proposal: A mixed methods appraisal tool for systematic mixed studies reviews, McGill University, Department of Family Medicine* 2011.
23. Teri L, Logsdon RG, Uomoto J, et al. Behavioral treatment of depression in dementia patients: a controlled clinical trial. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences* 1997; 52: P159-P166.
24. Thomas SA, Walker MF, Macniven JA, et al. Communication and Low Mood (CALM): a randomized controlled trial of behavioural therapy for stroke patients with aphasia. *Clinical rehabilitation* 2013; 27: 398-408.
25. Travers C. Increasing enjoyable activities to treat depression in nursing home residents with dementia: A pilot study. *Dementia* 2017; 16: 204-218.
26. Ciechanowski P, Chaytor N, Miller J, et al. PEARLS depression treatment for individuals with epilepsy: a randomized controlled trial. *Epilepsy & Behavior* 2010; 19: 225-231.
27. Kirkness CJ, Cain KC, Becker KJ, et al. Randomized trial of telephone versus in-person delivery of a brief psychosocial intervention in post-stroke depression. *BMC research notes* 2017; 10: 500.
28. Mitchell PH, Veith RC, Becker KJ, et al. Brief psychosocial–behavioral intervention with antidepressant reduces poststroke depression significantly more than usual care with antidepressant: living well with stroke: randomized, controlled trial. *Stroke* 2009; 40: 3073-3078.
29. Hart T, Vaccaro M, Collier G, et al. Promoting mental health in traumatic brain injury using single-session Behavioural Activation and SMS messaging: A randomized controlled trial. *Neuropsychol Rehabil* 2019: 1-20. 2019/03/15. DOI: 10.1080/09602011.2019.1592761.
30. Butterfield LC, Cimino CR, Salazar R, et al. The Parkinson's Active Living (PAL) Program: a behavioral intervention targeting apathy in Parkinson's disease. *Journal of geriatric psychiatry and neurology* 2017; 30: 11-25.
31. Feliciano L, Steers ME, Elite-Marcandonatou A, et al. Applications of preference assessment procedures in depression and agitation management in elders with dementia. *Clinical Gerontologist* 2009; 32: 239-259.
32. Teri L and Uomoto JM. Reducing excess disability in dementia patients: Training caregivers to manage patient depression. *Clinical Gerontologist* 1991; 10: 49-63.
33. Smith JD. Single-case experimental designs: a systematic review of published research and current standards. *Psychological Methods* 2012; 17: 510-550. 2012/08/01. DOI: 10.1037/a0029312.

34. Alexopoulos GS, Abrams RC, Young RC, et al. Cornell scale for depression in dementia. *Biological psychiatry* 1988; 23: 271-284.
35. Hamilton M. A rating scale for depression. *Journal of neurology, neurosurgery, and psychiatry* 1960; 23: 56.
36. Lincoln N, Sutcliffe L and Unsworth G. Validation of the Stroke Aphasic Depression Questionnaire (SADQ) for use with patients in hospital. *Clin Neuropsychol Assess* 2000; 1: 88-96.
37. Yesavage JA, Brink TL, Rose TL, et al. Development and validation of a geriatric depression screening scale: a preliminary report. *Journal of psychiatric research* 1982; 17: 37-49. 1982/01/01.
38. Kroenke K, Spitzer RL and Williams JB. The PHQ-9: validity of a brief depression severity measure. *J Gen Intern Med* 2001; 16: 606-613. DOI: 10.1046/j.1525-1497.2001.016009606.x.
39. Derogatis LR, Lipman RS, Rickels K, et al. The Hopkins Symptom Checklist (HSCL): A self-report symptom inventory. *Behavioral science* 1974; 19: 1-15.
40. Hand A, Oates LL, Gray WK, et al. The role and profile of the informal carer in meeting the needs of people with advancing Parkinson's disease. *Aging & mental health* 2017: 1-8.

503 **Table 1**

504 *Summary of the extracted data*

Study number, author(s), date, and country	[31] Feliciano, Steers, Elite-Marcandonatou, McLane, & Areán (2009), USA	[23] Teri, Logsdon, Uomoto, & McCurry (1997), USA	[25] Travers (2017), Australia	[32] Teri and Uomoto (1991), USA	[24] Thomas, Walker, Macniven, Haworth, & Lincoln (2013), UK	[27] Kirkness, Cain et al. (2017), USA	[28] Mitchell, Veith, et al. (2009), USA	[26] Ciechanowski, Chaytor et al. (2010), USA	[30] Butterfield, Cimino, et al. (2017), USA	[29] Hart, Vaccaro, Collier, Chervoneva & Fann (2019), USA
Method, recruitment, & depression identification method	Single case experimental design. Pre-post-test. Non-concurrent multiple baseline design. Community: CSDD	RCT. Community: Caregiver report, Clinical interview, CSDD, HDRS	Pilot RCT. Interview with care staff. Community: GDS	Single case experimental design. Pre-post-test (*n*=2), AB (*n*=1), ABAB (*n*=1). Community: DSM-III criteria, HDRS	RCT. Community: SADQH-10, PSADQH-21	RCT. Community: Screen: GDS ≥11; Study start: Clinical interview, DSM-IV criteria, HDRS	RCT. Community: Screen: GDS ≥11; Study start: Clinical interview, DSM-IV criteria, HDRS	RCT. Community: PHQ-9	Experimental design. Pre-/post- test. Community: GDS	RCT. NR. Patient Health Questionnaire-9
Sample characteristics	**Population:** Dementia **Total:** *n*=11 **Age (Years):** Range =78-95, *M*=85.6 **Female gender:** *n*=10 (91%) **Intervention:** Masters-level clinicians *n*=2	**Population**: Dementia **Total**: *n*=72 participant-caregiver dyads; BT-PE *n*=23; BT-PS *n*=19; Usual care *n*=10; Wait list control *n*=20 **Age (Years)**: Range = not reported, *M*=76.4 (*SD*=8.2); BT-PE *M*=72.8 (*SD*=8.2); BT-PS *M* =78.5 (*SD*=7.9); Usual care *M*=79.5 (*SD*=6.9), Wait list control *M*=76.8 (*SD*=8.2); Caregiver *M*=66.9 (*SD*=11.0) **Female gender**: *n*=34 (47%); BT-PE *n*=16 (70%); BT-PS *n*=5 (26%); Usual	**Population:** Dementia **Total:** *n*=18; BT *n*=10; Walking and talking *n*=8 **Age (Years):** Range = not reported, *M*=86.5 (*SD*=8.8); BT *M*=87.2 (*SD*=7.7); Walking and talking *M*=85.5 (*SD*=10.9) **Female gender:** *n*=16 (89%); BT *n*=8	**Population:** Dementia **Total:** *n*=4 patient caregiver dyads **Age (Years):** Range=74-81, *M*=78 (*SD*=3.16); Caregiver range=32-47, *M*=38.5 (*SD*=7.23) **Female gender:** *n*=2 (50%); Caregiver *n*=2 (50%) **Intervention:** Psychologist (*n*=1); Caregiver (*n*=4)	**Population:** Stroke with aphasia **Total:** *n*=105; BT *n*=51; Usual care *n*=54 **Age (Years):** Range=29-94, *M*=67.0 (*SD*=13.5); BT *M*=68.5 (*SD*=13.1); Usual care *M*=65.5 (*SD*=13.9) **Female gender:** *n*=39 (37%); BT *n*=22 (43%); Usual care *n*=17 (31%) **Intervention:** Assistant psychologists (*n*=8)	**Population:** Stroke **Total:** *n*=100; Intervention telephone *n*=37; Intervention face-to-face *n*=35; Usual care *n*=28 **Age (Years):** Range=23-88, *M*=NR; Intervention telephone =31-85, *M*=61.7; Intervention face-to-face =23-83, *M*=58.5 (*SD*=NR); Usual care =32-88, *M* = 60.7 (*SD* = NR) **Female gender:** *n*=50 (50%); Intervention telephone *n*=18	**Population:** Stroke **Total:** *n*=101; Intervention *n*=48; Usual care *n*=53 **Age (Years):** Range 25-89, *M*=NR; Intervention =25-88, *M*=57 (*SD*=NR); Usual care =29-88, *M*=57 (*SD*=NR) **Female gender:** *n*=40 (40%); Intervention *n*=19 (40%);	**Population:** Epilepsy **Total:** *n*=80; BT *n*=40; Usual care *n*=40 **Age (Years):** Range=NR, *M*=43.9 (*SD*=11.0); BT *M*=43.4 (*SD*=11.0); Usual care *M*=44.4 (*SD*=11.1) **Female gender:** *n*=42 (53%); BT *n*=19 (48%); Usual care *n*=23 (58%) **Intervention:** Social workers *n*=3	**Population:** Parkinson's disease **Total:** *n*=34 (27 analysed). *n*=27 spouse/family members **Age (Years):** Range=44-86, *M*=66 (*SD*=10.7) **Female gender:** *n*=5 (19%) **Intervention:** Principle investigator (*n*=1), students (*n*=3)	**Population:** Brain Injury **Total:** *n= 65;* BA intervention *n*=43, Motivation intervention *n*=22. Attrition *n*=6 (BA intervention = 5, Motivation intervention =1) **Age (Years):** Range NR, BA intervention *M* 40.4, Motivation intervention *M* 38.5. **Female gender:** 12 (20.3%). BA intervention *n*=8 (21%), Motivation intervention *n*=4 (19%). **Intervention:** Researchers

		care *n*=6 (60%); Wait list control *n*=7 (35%); Female caregiver *n*=50 (69%) **Intervention**: Psychologist (*n*=1)	(80%); Walking and talking *n*=8 (100%) **Intervention:** Care staff (*n*=NR) **Interview:** Staff (*n*=14)			(49%); Intervention face-to-face *n*=18 (51%); Usual care *n*=14 (50%) **Intervention:** Study therapist (*n*=1)	Usual care *n*=21 (40%) **Intervention:** Study therapist (*n*=1)			
Intervention and format	**Manualised:** No **Components:** Identifying pleasurable activities, communicating activities to caregivers, Developing behaviour plans **Number and length of sessions:** NR **Mode of delivery:** Face-to-face **Format:** Individual **Comparator:** None	**Manualised:** Yes **Components:** Psychoeducation for caregivers, Psychoeducation, identifying activities, Activity scheduling, Activity monitoring, Caregiver problem-solving, Caregiver activity scheduling, Working with behavioural disturbances, Relapse prevention **Number and length of sessions:** 9 (1-hr) **Mode of delivery:** Face-to face. Caregiver supported by therapist **Format:** Individual **Comparator:** BT-PS, Usual care, Wait list control	**Manualised:** Yes (BE-ACTIV) **Components:** Involving activities staff, 3-hr staff training component, identifying activities, Activity scheduling, increasing activities, Behavioural management **Number and length of sessions:** 8 sessions (NR) **Mode of delivery:** Face-to-face **Format:** Individual **Comparator:** Walking and talking	**Manualised:** No **Components:** Psychoeducation for patients and caregivers, identifying activities, Engagement in activities, Activity tasks supported by caregivers **Number and length of sessions:** 8 (1-hr). Patient 3 of 8 sessions, caregiver 8 of 8 sessions. **Mode of delivery:** Face-to-face **Format:** Individual and caregiver **Comparator:** None	**Manualised:** Yes **Components:** Maximising mood-elevating activities, Psychoeducation, Activity monitoring, Activity scheduling, Grading tasks, Communication adaptations **Number and length of sessions:** <20, *M*=9.07 (*SD*=2.36), range 3-18 (1-hr) **Mode of delivery:** Face-to-face **Format:** Individual **Comparator:** Usual care	**Manualised:** Yes **Components:** Psychoeducation, Identifying activities, Activity scheduling, Problem-solving, Skills review **Number and length of sessions:** 6 (10-80 min). Telephone intervention *M*=26 min, face-to-face *M*=38 min **Mode of delivery:** Group 1, telephone; Group 2, face-to-face **Format:** Individual **Comparator:** Usual care	**Manualised:** Yes **Components:** Psychoeducation, Identifying activities, Activity scheduling, Problem-solving, Skills review **Number and length of sessions:** 9 (NR) **Mode of delivery:** Face-to-face **Format:** Individual **Comparator:** Usual care	**Manualised:** Yes (PEARLS) **Components:** Activity scheduling, Activity monitoring, Behavioural activation, Problem-solving, Focus on social and physical activation **Number and length of sessions:** 8 (50 min) **Mode of delivery:** Face-to-face, telephone **Format:** Individual **Comparator:** Usual care	**Manualised:** Yes (BATD) **Components:** Goal setting, Activity scheduling, Activity monitoring **Number and length of sessions:** 6 (2-2.5-hr, n=1; 10-20 min. *n*=5) **Mode of delivery:** Face-to-face (*n*=1), telephone (*n*=5), automated web reminders **Format:** Individual **Comparator:** None	**Manualised:** Scripted sessions **Components:** Psychoeducation, identifying activities, activity scheduling, implementation intentions **Number and length of sessions:** Face-to-face (*n*=1), telephone (*n*=1), Text messages (*n*=8) **Mode of delivery:** Face-to-face and telephone **Format:** Individual **Comparator:** Motivation interventions

Measurement time points and measures. Effect size*	**Pre- and post-Intervention:** CMAI-Long form, MAS, MMSE, ADL, CSDD, PES, RAISD. **Effect size:** NR/insufficient data	**Pre- and post-Intervention:** CSDD, HDRS, MMSE, DRS, RIL **Caregiver:** HDRS **Effect size:** Depression: BT-PE & BT-PS effect size ranged from *d*=0.9-1.7 on the HDRS and CSD BT-PE BDI *d*=0.4; BT-PS BDI *d*=1.0 Caregiver: HDRS [F(3,66) = 4.73, p < .01] **6-month follow up** Significant effects on reduced sample maintained.	**Pre- and post-Intervention:** GDS, QOL-AD-nursing home, PES-nursing home, MMSE. **Effect size:** NR/insufficient data	**Pre- and post-Intervention daily:** HDRS, PES-elderly version (caregiver to patient), MMSE, **Caregiver:** HDRS **Effect size:** N/A	**3- and 6-months post-randomisation:** SADQH-10, SADQH-21, NLQ, CSI, SST, FAST, BI, VASES **Effect size:** Depression: Three-month d_{Korr} = 0.542; Six-month d_{Korr} = 0.771	**Baseline, 8-weeks (post-intervention), 21-weeks, 12-months:** HDRS, NIHSS, GDS, BI, SIS **Effect size**: Depression: 8-week *d*= 0.243; 21-week *d*= 0.053; 12-month *d*= 0.104	**Baseline, 9-weeks (post-intervention), 21-weeks, 12-months:** HDRS, NIHSS, GDS, BI, SIS **Effect size:** Depression: 9-week *d* = 1.172; 21-week *d*= 0.341; 12-months *d*= 0.484; 24-month *d*= 0.398	**Baseline, 6- and 12-months:** HSCL-20, QOLIE-31 **Effect size:** Depression: 6-month *d*= 0.38; 12-month *d*= 0.704	**Baseline, post-intervention, 1-month follow-up:** AES, GDS, UPDRS, PDQ-39 **Caregiver:** ZBI **Effect size:** Depression: *d*= 0.70; Apathy: *d*= 0.77; Quality of Life: *d*= 0.5	**Pre-, mid-, and post-intervention:** EROS, BADS **Effect size:** NR
Summary points and key findings	Only four participants were depressed - change was observed in two of the four. One participant had a clinically significant change (a 11-point drop) and one participant had a small decrease in score that was not clinically significant. PES was completed with eight participants (73%) the remaining 3 were completed by family members or care staff.	Participants in both behavioural groups showed significant improvement in depressive symptoms compared to those in the usual care and wait list control. Caregiver depression improved on the HDRS. 25 participants (60%; 95% CI = [.45, .74]) in the active treatment conditions showed clinically significant improvement. At six-months participants and	The average number of activities completed by the intervention group increased from baseline (*z*= 2.82, *p*< 0.005). Quality of life improved in the walking and talking group (*p*=0.04) from baseline. Qualitative	Significant positive relationship between depressed mood and duration and frequency of activities. Less depressed mood was associated with a longer duration and higher frequency of activities. The duration of activities may be more important to mood than frequency of activities. No baseline data	Allocation to behavioural activation compared to usual care significantly predicted better self-reported mood, self-esteem and observer-rated mood three months after randomisation. No significant effects for behavioural activation on caregiver strain or leisure activities (*p* values not reported). Both participants and caregivers reported higher satisfaction	Intervention groups were combined and had a mean reduction on HDRS scores of 39% (40% face-to-face and 38% telephone) compared to 33% reduction in usual care at 8 weeks, no significant difference. The modality of intervention (face-to-face and telephone) were comparable for outcomes.	Mean decrease in depression was significantly greater at 1-year compared to control.	Intervention resulted in significantly greater depressive symptom reduction over 12-months compared with usual care.	Apathy and depression scores were significantly different with a large effect size. Depression scores were maintained one month follow up.	The difference between conditions was not significant for 8-week changes or 4-week changes for any outcome measure.

		caregivers in active treatment conditions (BT-PE & BT-PS) maintained significant improvement.	comments: 93% of staff reported benefits for the intervention group. They reported improved mood in four residents and greatly reduced anxiety in one resident, from baseline.	was collected for 50% of the participants Caregiver depression: Caregivers with depression at pre-treatment (*n*=2) showed a reduction in HDRS and BDI scores.	with emotional support, communication support, and hospital and community services.					

Note: * all favoured intervention. NR = Not reported.

ADL; Katz Basic Activities of Daily living scale, AES; Apathy Evaluation Scale, BADS; Behavioural Activation for Depression Scale, BATD; Brief Behavioural Activation Treatment for Depression, BDI; Beck Depression Inventory, BI; Barthel Index, CMAI; Cohen -Mansfield Agitation Inventory-Long form, BT-PE; Behavioural therapy pleasant events, BT-PS; Behavioural therapy problem-solving, CSDD; Cornell Scale for Depression in Dementia, CSI; Carer Strain Index, DRS; Dementia Rating Scale, DSM-III; Diagnostic and Statistical Manual of Mental Disorders-III, EROS; Environmental Reward Observation Scale, FAST; Frenchay Aphasia Screening Test, GDS; Geriatric Depression Scale, HDRS; Hamilton Depression Rating Scale, HSCL-20; Hopkins Symptom Checklist – 20, MAS; The motivation assessment scale, MMSE; Mini–Mental State Examination, NIHSS; National Institutes of Health Stroke Scale score, NLQ; Nottingham Leisure Questionnaire, PDQ-39; Parkinson's Disease Quality of Life, PEARLS; Program to Encourage active, Rewarding Lives for Senior, PES; The pleasant events schedule, PHQ9; Patient Health Questionnaire-9, QOL-AD; Quality of life - Alzheimer's disease, QOLIE-31; Quality of life in Epilepsy – 31, RAISD; Reinforcer assessment for individuals with severe disabilities, RIL; Record of Independent Living, SADQH-10; Stroke Aphasic Depression Questionnaire Hospitals-10 item, SADQH-21; Stroke Aphasic Depression Questionnaire Hospitals-21 item, SIS; Stroke Impact Scale, SST; Sheffield Screening Test, UPDRS; Unified Parkinson's Disease Rating Scale, VASES; Visual Analogue Self-Esteem Scale, ZBI; Zarit Burden Inventory.

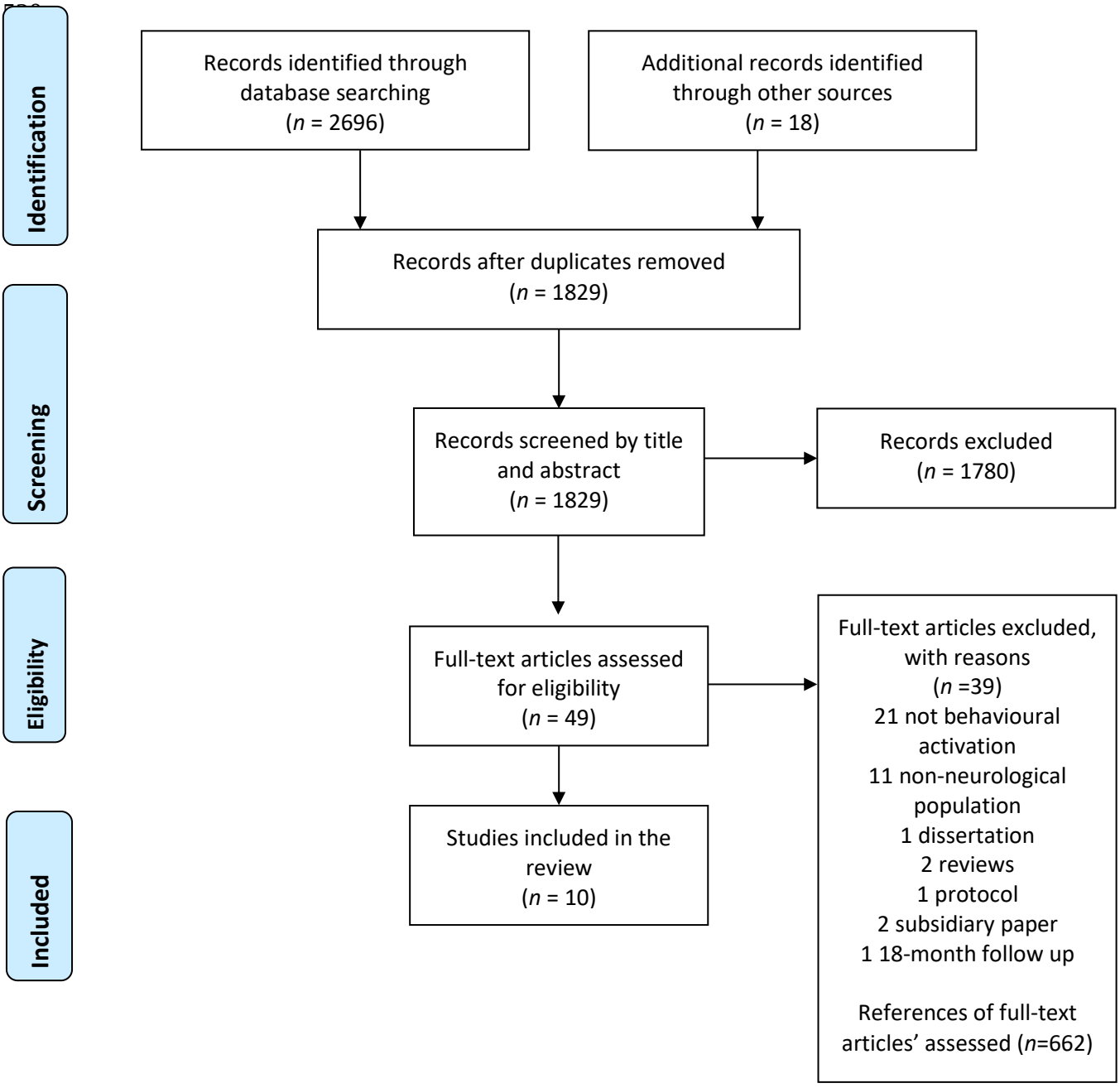
Table 2

Methodological characteristics of studies

Study	Clear statement of aims	Participant demographics	Sample representativeness (*n*)	Inclusion and exclusion criteria	Standardised measures	Attrition	Randomisation	Blinding	Treatment fidelity	Additional sources of bias
Feliciano, Steers [31]	Yes	Moderate	No (*n*=11), participants with depression (*n*=4)	No	Yes	Yes	N/A	N/A	No	Selection bias Reporting bias Confounders
Teri, Logsdon [23]	Yes	Yes	Yes (*n* =72)	Yes	Yes	Yes	Moderate	Yes	No	Confounders
Travers [25]	Yes	Yes	No (*n* =18)	Yes	Moderate	Yes	Yes	No	No	Selection bias Detection bias Performance bias
Teri and Uomoto [32]	Yes	No	No (*n* =4)	No	Yes	No	N/A	N/A	No	Selection bias Detection bias Confounders
Thomas, Walker [24]	Yes	Yes	Yes (*n* =105)	Yes	Yes	Yes	Yes	Moderate	Yes	
Kirkness, Cain [27]	Yes	Yes	Moderate (*n* =100)	Moderate	Yes	Yes	Yes	Yes	Moderate	Reporting bias Concurrent intervention
Mitchell, Veith [28]	Yes	Yes	Yes (*n* =101)	Moderate	Yes	Yes	Yes	Yes	No	Change scores calculated rather than absolute difference between groups
Ciechanowski, Chaytor [26]	Yes	Yes	Yes (*n* =80)	Moderate	Moderate	Yes	Yes	Yes	Moderate	
Butterfield, Cimino [30]	Yes	Moderate	Moderate (*n* =34)	Moderate	Yes	Yes	N/A	N/A	Yes	
Hart, Vaccaro [29]	Yes	Yes	Yes (*n* = 65)	Yes	Yes	Yes	Yes	Yes	Moderate	

Note. Table collates Critical Appraisal Skills Programme tools for a single point of reference

519 *Figure 1. PRISMA Flow Diagram*



Appendices

Appendix A. Example search strategy for PsycINFO

1	neurological conditions
2	neurological disorders
3	neurological illness
4	brain injury
5	Dementia
6	alzheimer*
7	multiple sclerosis or ms
8	huntington*
9	stroke
10	parkinson*
11	ataxia
12	dystonia
13	motor neurone disease or als or mnd or amyotrophic lateral sclerosis
14	chronic fatigue syndrome or myalgic encephalomyelitis
15	muscular dystrophy
16	progressive supranuclear palsy
17	transverse myelitis
18	spinal injury
19	meningitis
20	epilepsy
21	S1 OR S2 OR S3 OR S4 OR S5 OR S6 OR S7 OR S8 OR S9 OR S10 OR S11 OR S12 OR S13 OR S14 OR S15 OR S16 OR S17 OR S18 OR S19 OR S20
22	(MH "Depression")
23	depression
24	low mood
25	dysthymia
26	depressive
27	depressed
28	depressive disorder
29	S22 OR S23 OR S24 OR S25 OR S26 OR S27 OR S28
30	behavio* activation
31	behavio* therapy
32	activity schedul*
33	positive reinforce*
34	event schedul*
35	behavio* treatment
36	behavio* intervention
37	behavio* therap*
38	behavio* activat*
39	behavio* modif*
40	behavio* psychotherap*
41	S30 OR S31 OR S32 OR S33 OR S34 OR S35 OR S36 OR S37 OR S38 OR S39 OR S40
42	S21 AND S29 AND S41

Appendix B. Data extraction template headings

Data were extracted using the following headings: (a) study identifiers: title, authors, date, country/location, (b) study characteristics: methodology, sample size, aims, design, inclusion/exclusion criteria, recruitment method, randomised-controlled trials details, incomplete data, attrition, bias, (c) participants': age, gender, depression scores, ethnicity, primary and secondary health condition, (d) intervention: delivery format, intervention facilitator, individual/group, session duration, number of sessions, intervention setting, behavioural activation manual, fidelity checks, adaptations, comparator/control, (e) outcome measures: primary measure, quality of measure, secondary measure, quality of secondary measure, duration assessed/follow up, (f) analysis: quantitative/qualitative, tests used, missing data reported, and (g) results/findings: primary, secondary, comparator/control, themes, comments, and effects on neurological condition reported.